
DOMESTIC PREPAREDNESS
Chemical Team
Chemical Weapons
Improved Response
Program
SCIENTIA
DEFENDIMUS
CITY OF BALTIMORE
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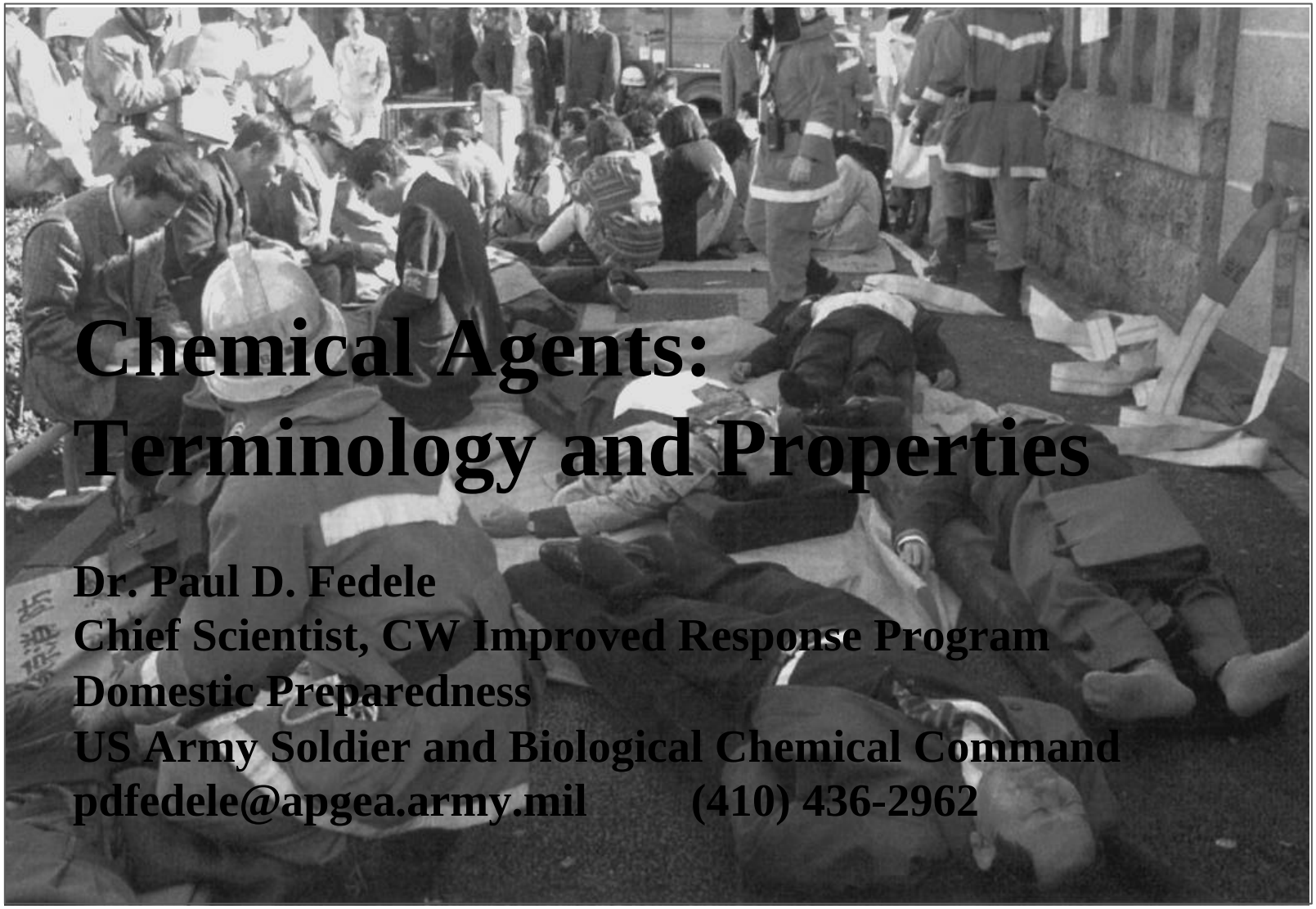

Chemical Agents: Terminology and Properties

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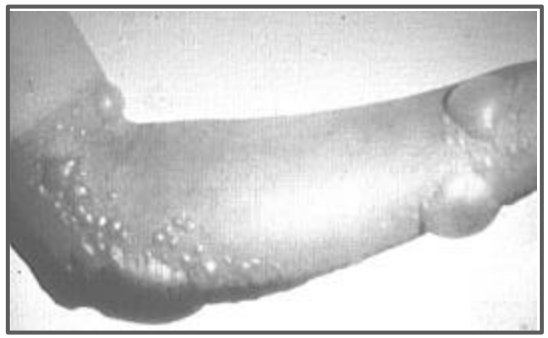
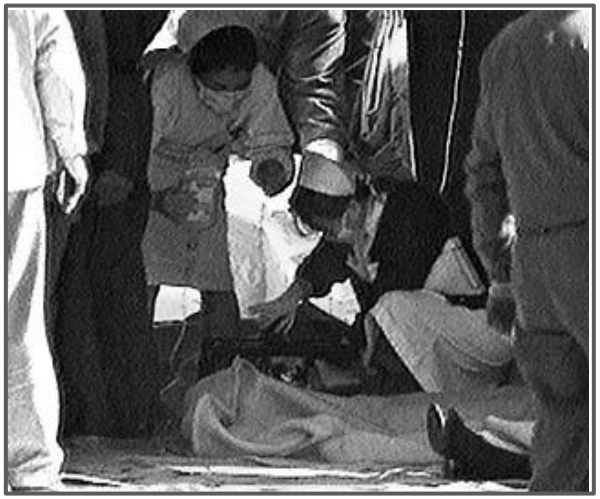
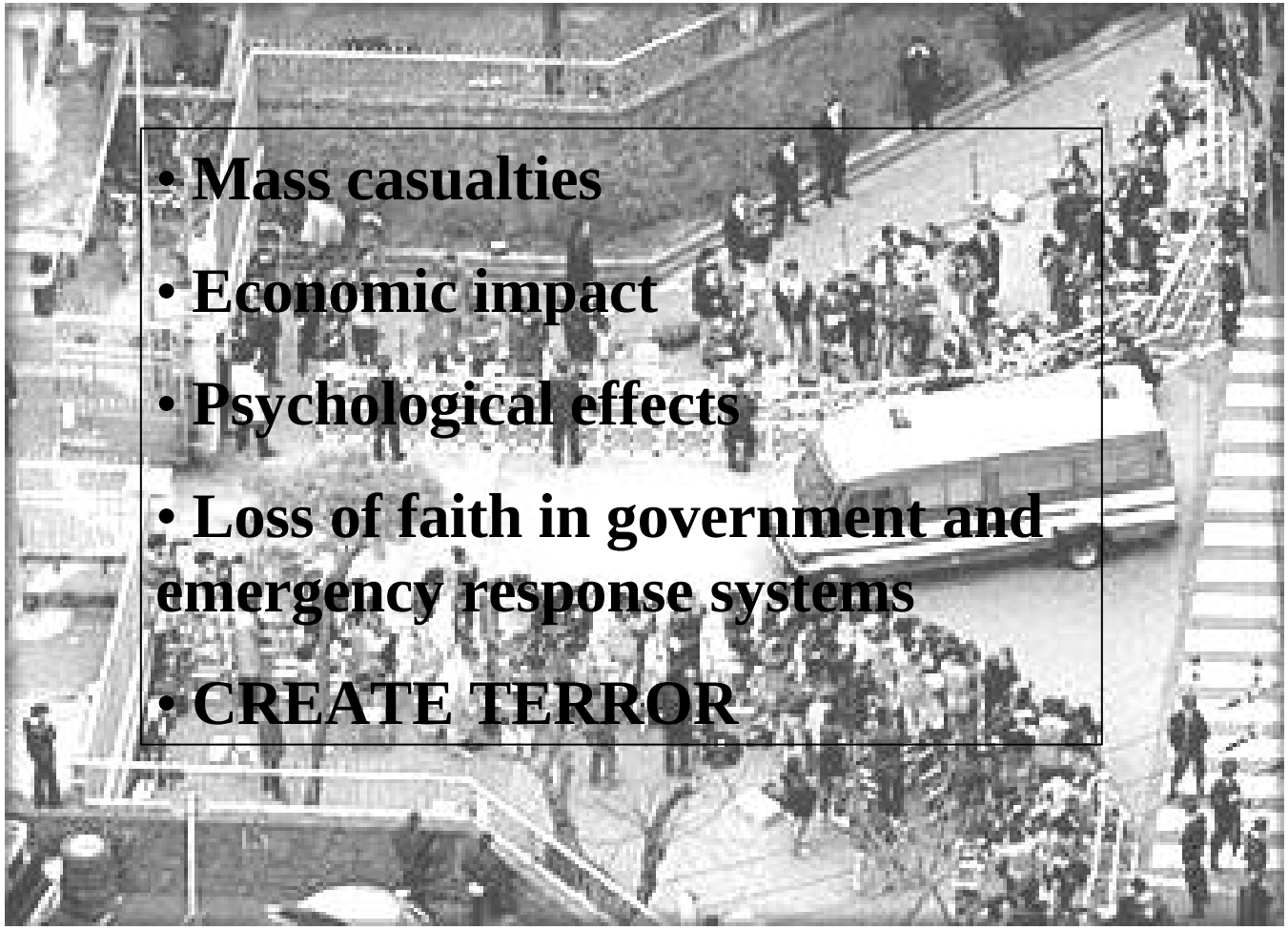
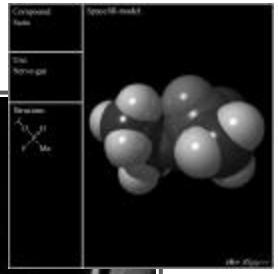


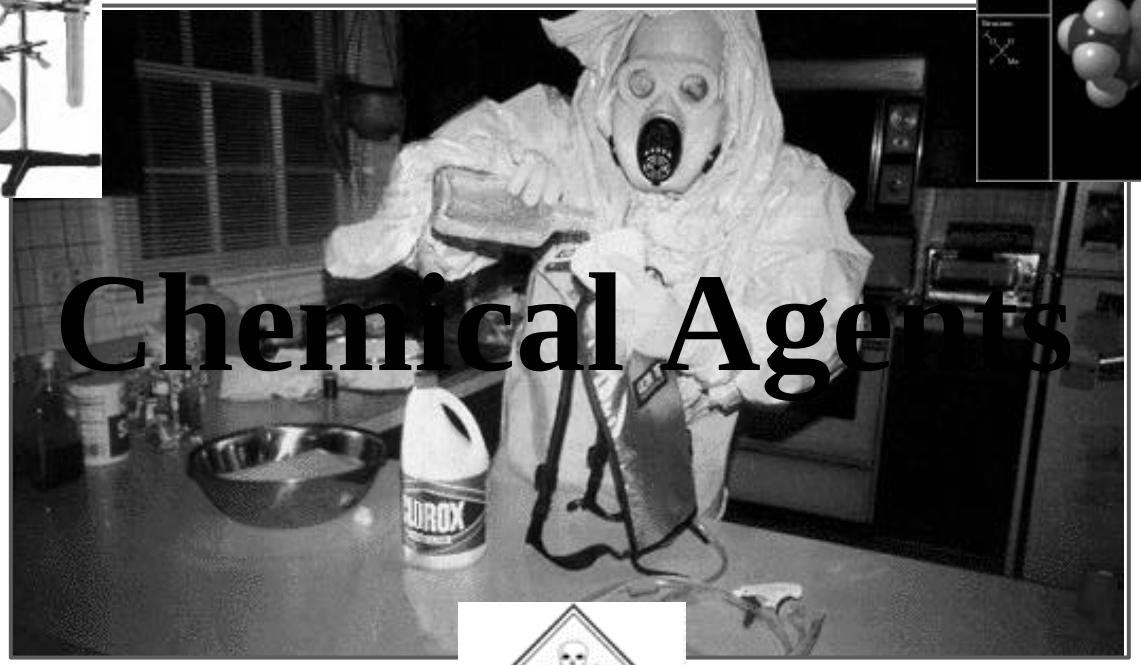


Why Chemical Terrorism



- Mass casualties
- Economic impact
- Psychological effects
- Loss of faith in government and emergency response systems
- CREATE TERROR





Chemical Agents

Toxic Industrial Compounds

- **Industrial chemicals**
  - **Chlorine**
  - **Hydrogen cyanide**
  - **Phosgene**

- **All are common industrial compounds**
- **All can either be purchased, stolen or easily made**
- **Most likely form of chemical terrorism**
  - **Higher probability of occurrence, lower level of impact**

Chemical Warfare Agents

- **Military unique chemicals**
- **Difficult to make and obtain**
- **Nerve agents**
  - **Sarin (GB)**
  - **Soman (GD)**
  - **VX (VX)**
- **Blister agents**
  - **Mustard (H)**
  - **Lewisite (L)**

- **Lower probability of occurrence, higher impact**

Toxic Industrial Compounds

Chlorine

- **Agent of opportunity rather than choice**
- **Widely used industrial chemical**
- **First significant chemical warfare agent of WWI**
- **Released in movie theatres in four states in 1999**
  - **Lung damaging**
  - **Chemical pneumonia**

Toxic Industrial Compounds

Hydrogen Cyanide

- **Easily made from widely used industrial chemicals**
- **Gas at room temperature**
- **Blood poison**
  - **Rapid acting**
  - **Death within 15 minutes with lethal dose**

Toxic Industrial Compounds

Phosgene

- **Widely used industrial chemical**
- **WWI chemical warfare agent**
- **Difficult to make, can be purchased or stolen**
- **Lung poison**
  - **Delayed action**
  - **Chemical pneumonia**

Chemical Warfare Agents

Nerve Agents

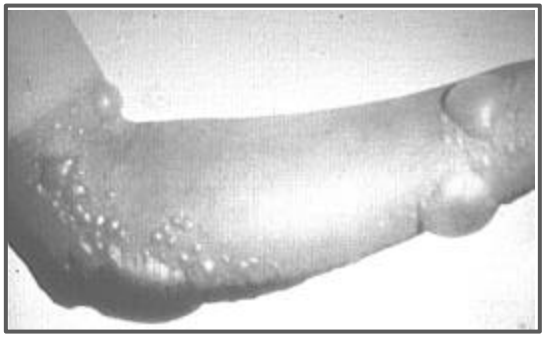
- **Sarin (GB) – A very volatile non-persistent agent. Vapor inhalation causes death in seconds to minutes, skin exposure causes death in minutes.**
- **Soman (GD) – Less volatile, more persistent and toxic by skin contact**
- **VX – Not volatile, very persistent and much more toxic by skin contact**
- **Large military stockpiles of all**

Lethal Dose of VX by Skin Contact

Chemical Warfare Agents

Blistering Agents

- **Primary effect is blistering on skin by contact with liquid**
  - **Mustard – delayed effects**
  - **Lewisite – rapid acting**
- **Highly persistent**
- **Large military stockpiles**



Volatility of Chemical Agents and Water
Agent and Water Volatility*

• Chlorine	20,000,000 : 6,900,000
• Phosgene (CG)	10,000,000 : 2,500,000
• Hydrogen cyanide	1,000,000 : 910,00
• Water	22,900 : 31,000
• Sarin (GB)	22,000 : 3,800
• Soman (GD)	3,900 : 520
• Sulfur mustard (H)	920 : 140
• Tabun (GA)	610 : 92
• VX	10 : 0.9

* Approximate amount of agent (mg) that 1 m^3 of air can hold at 25 ^oC

Toxicity of Chemical Agents
Vapor Inhalation Toxicity

Agent	(mg min/m^3) : (PPM min)
• Chlorine	19,400 : 6,500
• Phosgene (CG)	3,200 : 790
• Hydrogen cyanide	2,000 : 1800
• Sarin (GB)	18 : 3.1
• Soman (GD)	18 : 2.4
• Sulfur mustard (H)	900 : 140
• Tabun (GA)	40 : 6.0
• VX	13 : 1.2

'Review of Acute Human-Toxicity Estimates for Selected Chemical Warfare Agents", Committee On Toxicology, National Research Council, 1997', from: http://books.nap.edu/books/0309057493/html/index.html

Fire and Rescue

Awareness and Recognition

Signs and symptoms first indicator for responders

Nerve Agents

- ✓Pinpointed pupils
- ✓Runny nose
- ✓Drooling
- ✓Difficulty breathing
- ✓Nausea/vomiting
- ✓Muscle twitching
- ✓Death

Blister Agents

- ✓Immediate eye pain (Lewisite)
- ✓Reddening of eyes
- ✓Hacking cough
- ✓Redness of skin
- ✓Blisters

Odors of Chemical Agents

Agent	Odor
• Chlorine	Bleach
• Phosgene (CG)	New-mown hay, grass
• Hydrogen cyanide	Faint bitter almonds
• Sarin (GB)	None
• Soman (GD)	Fruity
• Sulfur mustard (H)	Garlic or horseradish
• Tabun (GA)	Faint fruity to none
• VX	None

Solubility of Chemical Agents in Water

Agent	Solubility
• Chlorine	soluble
• Hydrogen cyanide	highly soluble
• Sarin (GB)	miscible
• Soman (GD)	2.1 %
• Sulfur mustard (H)	<1%
• Tabun (GA)	8%
• VX	miscible below 10 C

Response to Chemical Terrorism
Chemical Agents Summary

- **CWA create fear and uncertainty**
- **Protective equipment is needed to protect responders**
- **Victim symptoms, reported odors, awareness, and training are keys to detection and self-protection**

Further CW IRP Information

CWIRP reports are available over the internet at the web site:

http://www2.sbccom.army.mil/hld/index.htm

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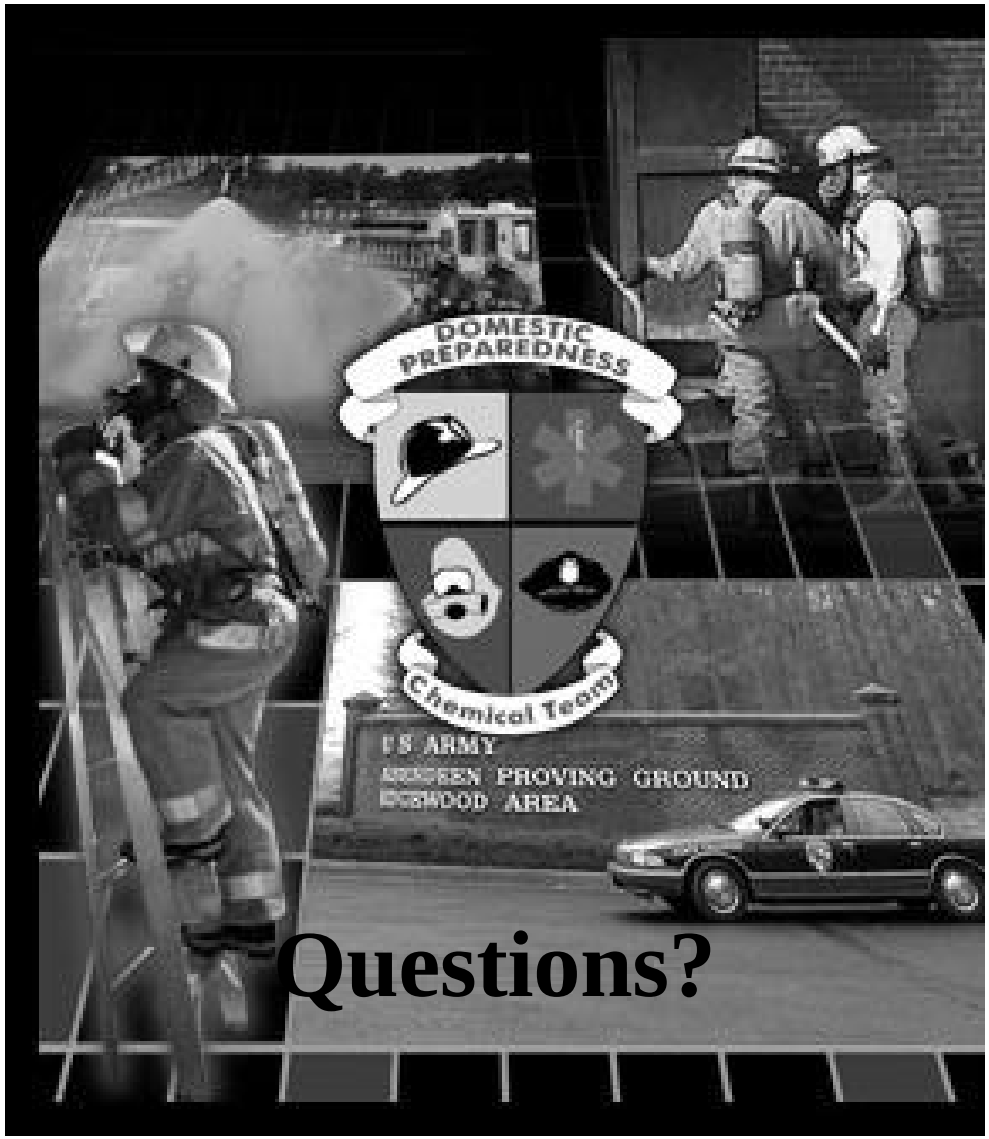
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Questions?